



**Tennessee Valley Authority, Post Office Box 2000, Soddy-Daisy, Tennessee 37384-2000**

February 5, 2004

10 CFR 50.54 (f)

U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, D.C. 20005-0001

Gentlemen:

In the Matter of                                 )  
Tennessee Valley Authority                 )

Docket No. 50-328

SEQUOYAH NUCLEAR PLANT (SQN) UNIT 2, NRC BULLETIN 2003-02,  
"LEAKAGE FROM REACTOR PRESSURE VESSEL LOWER HEAD  
PENETRATIONS AND REACTOR COOLANT PRESSURE BOUNDARY  
INTEGRITY," (TAC No. MC0564) AND NRC ORDER EA-03-009 -  
INTERIM INSPECTION REQUIREMENTS FOR REACTOR PRESSURE VESSEL  
HEADS AT PRESSURIZED WATER REACTORS

- References: 1. TVA Letter to NRC dated September 22, 2003, "Sequoyah Nuclear Plant (SQN) Units 1 and 2 and Watts Bar Nuclear Plant (WBN) Unit 1 - Thirty-Day Response to NRC Bulletin 2003-02, 'Leakage from Reactor Pressure Vessel Lower Head Penetrations and Reactor Coolant Pressure Boundary Integrity,' dated August 21, 2003"
2. TVA letter to NRC dated June 13, 2002, "Sequoyah Nuclear Plant (SQN) - Unit 2 Item 5 Response to NRC Bulletin 2001-01, 'Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles,' dated August 3, 2001 (TAC No. MB2660) - Unit 2, Item 2 Response to NRC Bulletin 2002-01, 'Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity,' dated March 18, 2002 (TAC No. MB4579)"

A109

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The purpose of this letter is to update NRC regarding the status of SQN Unit 2 reactor pressure vessel (RPV) upper head inspections and the inspection results for the lower head.

The subject NRC Order, Item IV.C.(3) states:

"For those plants in the Low category, RPV head and head penetration nozzle inspections shall be performed as follows. An inspection meeting the requirements of 3(a) must be completed at least every third refueling outage or every five (5) years, whichever occurs first. If an inspection meeting the requirements of 3(a) was not performed during the refueling outage immediately preceding the issuance of this Order, the Licensee must complete an inspection meeting the requirements of 3(a) within the first two (2) refueling outages following issuance of the order."

In accordance with item 3(a) of the NRC Order, SQN Unit 2 falls in the low susceptibility category and requires a bare metal visual inspection of 100 percent of the RPV head surface (including 360 degrees around each RPV penetration nozzle). The inspection of SQN Unit 2 that complies with 3(a) of the NRC Order was performed during the Unit 2 Cycle 11 refueling outage that immediately preceded the issuance of the NRC Order. The results of the Unit 2 RPV head inspections were provided by Reference 2 in accordance with Section IV, Paragraph E of the NRC Order EA 03-009.

Item 2 of NRC Bulletin 2003-02 requires Licensees to submit a report detailing the inspection results of the lower head within sixty days after returning the plant to operation.

The RPV lower head inspections for SQN Unit 2 were performed during the SQN Unit 2 Cycle 12 refueling outage that ended December 11, 2003. Bare metal visual inspections were performed on the lower head penetrations and lower head surface by Level III visual testing (VT) certified personnel using video equipment mounted on remote magnetic crawlers. The examinations were recorded on videocassettes for archival and off-line review.

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A total of 58 RPV lower head penetrations and the lower head surface were examined. The VT results indicate no detectable boron leakage. A slight discoloration was noted in some areas of the lower head coating; however, no minimal surface corrosion was noted.

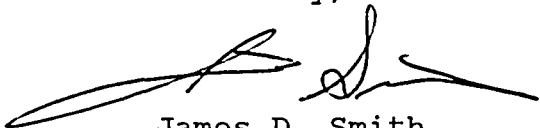
Enclosure 1 provides excerpts from the Examination Report Number BOP-2449 that documents the complete inspection of the lower head. The video, photographs, and resolution verification are filed as life-of-plant documentation.

Enclosure 2 provides TVA's engineering analysis associated with the observed discoloration (i.e., exterior residue).

If you have any questions regarding this response, please contact me at (423) 843-6672 or Pedro Salas at (423) 843-7170.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 5th day of February, 2004.

Sincerely,



James D. Smith  
Licensing Supervisor

Enclosures

cc (Enclosures):

Mr. Michael L. Marshall, Jr., Senior Project Manager  
U.S. Nuclear Regulatory Commission  
Mail Stop O-8G9A  
One White Flint North  
11555 Rockville Pike  
Rockville, Maryland 20852-2739

ENCLOSURE 1

TENNESSEE VALLEY AUTHORITY  
SEQUOYAH NUCLEAR PLANT (SQN)  
UNIT 2

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Reactor Pressure Vessel (RPV)  
Lower Head Examination Results  
(Excerpts from Report No. BOP-2448)

## SEQUOYAH UNIT 2, CYCLE 12

REACTOR PRESSURE VESSEL  
LOWER HEADREMOTE VISUAL (VT-2)  
BIM PENETRATION EXAMINATION

## FINAL REPORT - NOVEMBER 2003

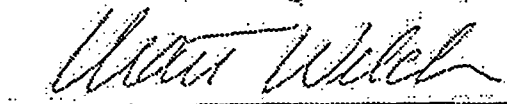
Prepared for: Component Engineering

Prepared by: Inspection Services Organization

  
Frank Leonard, Manager UT Section

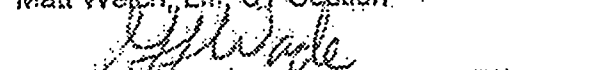
11/17/03

Date

  
Matt Welch, LIII, UT Section

11/12/03

Date

  
Gary Wade, ISI NDE Supervisor (Reviewer)

11/26/03

Date

**SEQUOYAH UNIT 2 CYCLE 12  
RPV LOWER HEAD VT-2 EXAM  
TABLE OF CONTENTS**

<b>Section</b>	<b>Description</b>
1.0	Examination Report
2.0	Scan Plan
3.0	Photographs
4.0	Resolution Verification
Attachment 1	NRC Bulletin 2003-02

**Sequoyah Unit 2, Cycle 12 – RPV Lower Head  
Remote Visual Penetration Examination Final Report**

***Visual Examination Report Summary***

**INTRODUCTION**

During the Sequoyah Unit 2 (SQN-2), Cycle 12 Refueling Outage, remote visual (VT) examinations were performed on the outside surface of the Reactor Pressure Vessel (RPV) Lower Head bottom mounted instrument (BMI) penetrations. TVA Inspection Services Organization (ISO) established a procedure to define the actions required to perform enhanced VT-2 examinations to detect reactor coolant pressure boundary (RCPB) leakage from the reactor vessel lower head penetrations. The examinations were performed on November 11-12, 2003 by Tennessee Valley Authority's ISO and Vistas Corporation.

The examination was implemented through SQN Work Order # 03-001060-000. This Work Order also established the requirements for access into the keyway (i.e. confined space status and heat stress requirements) and included tag-out requirements (2-94-609-RFO) to prevent retraction of the incore instrument thimble tubes. The examination was performed in accordance with NDE procedure N-VT-17, revision 3. The purpose of the VT examination was to identify any leakage from the instrument penetration annulus area and any degradation of the lower head from RCPB leakage. The annulus area is defined as the intersection between the RPV head and penetration, inclusive of ½ inch of adjacent RPV head base material. The examination included 100% of the RPV head surface and 360 degrees of the annulus. A total of 58 BMI penetrations and the lower head surface were examined. Personnel performing the examinations were certified as VTI LIII. System resolutions checks were performed at the initiation and completion of the examination, as a minimum (Ref. Section 4.0 for resolution documentation). Any suspected boron leakage areas were to be identified to Materials Engineering for resolution.

**TECHNICAL DISCUSSION**

**Remote VT Equipment**

TVA contracted with Vistas Corporation to provide and operate remote VT equipment to examine the RPV head penetrations. The remote examinations were performed with a Vistas tracked crawler, outfitted with a high resolution, 40:1 color zoom camera having an adjustable LED lighting array, tilt and zoom capabilities. Additionally, the crawler was equipped with both forward and rear viewing cameras used to aid in positional verification and progression.

The data acquisition and crawler control station were located on a platform in the keyway with the associated cabling routed to the RPV lower head. The camera mounted crawler was placed under the head on the insulation surface. Access to the examination area was provided by removing the peripheral insulation panels located below the vessel head. A ladder was placed at one of these openings.

**Sequoyah Unit 2, Cycle 12 – RPV Lower Head  
Remote Visual Penetration Examination Final Report**

The examinations were recorded on Digital 8 video cassette's for archival and off-line review. All penetration annulus areas and the head surface in the area on the penetrations were examined and digitally recorded.

#### **Procedure/Documentation**

The exam was performed in accordance with TVA/ISO NDE procedure N-VT-17, revision 3. ISO provided two Level III examiners certified in Visual examination to review and evaluate all data on-line.

The visual examination process utilized enhanced VT-2 methodology with camera resolution established on characters less than or equal to .105" high, representative of VT-3 sensitivity. (Ref: Section 3, Figure No's: 1 & 2)

#### **Examination Process**

An examination Scan Plan (Section 2.0) was developed in order to ensure that examinations were performed in a logical sequence, while minimizing radiation exposure and validating positional accuracy.

A total of 15 scan sequences were performed to examine all penetrations. During the examination of each penetration, the head area adjacent to the penetration was also visually examined for boron deposits as well as the overall head surface. Each BMI penetration was viewed in two separate 180-degree segments to ensure 100% coverage. In order to ensure positional verification, the outer peripheral penetration numbers were physically marked on the head surface adjacent to the tube. All of the numbers were video taped during the examination.

Radiation work permit (RWP) No. 27081 was used for the inspection work. The examination team received 378 mr. in 71 RWP hours.

### **RESULTS**

#### **Bare Head Surface Condition**

The overall condition of the bare head surface was very clean, with minimal coating degradation. The surface of the head and the instrumentation tubing exhibited markings consistent with construction activities. Ref: Section 3: Figure No's: 3 through 12

#### **Observations**

A dark stain was observed on 25 instrument tubes that originated approximately 1"-2" below the penetration (reference Section 3, Figure No's: 13-16). This condition was reported to site Engineering for evaluation and PER No. 03-016523-000 was generated to document the condition.



**Sequoyah Unit 2, Cycle 12 – RPV Lower Head  
Remote Visual Penetration Examination Final Report**

**CONCLUSION**

All 58 penetrations were accessible and the VT examination results indicated no detectable boron leakage. A slight discoloration was noted in some areas of the lower head coating; however, no minimal surface corrosion was noted. Examination results for each penetration are contained in Section 2.0.

LOCATION 01-58

INSTPEN-XX (PARTIAL PENETRATION WELD)

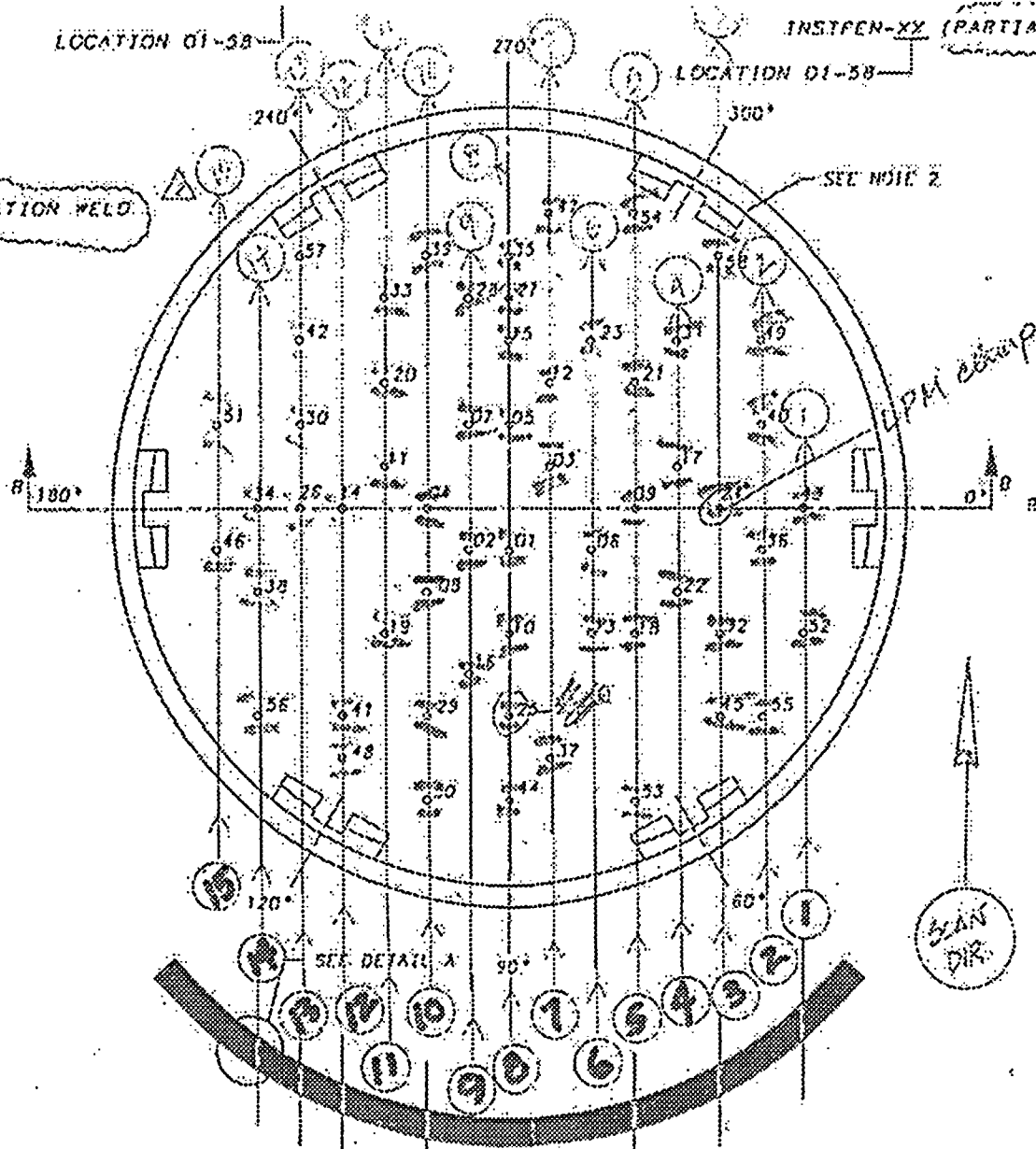
LOCATION 01-58

NOTES:

1. FOR UNIT 1 DWC SEE ISI-0504-1
2. SEE DWC ISI-0298-C FOR CORE GUIDE DETAIL.

SEE NOTE 2

PARTIAL PENETRATION WELD



REACTOR VESSEL COORDINATES

SECTION B-B

2	PPH	ADD	1	PPH	10/11/72
ADD WELD INFORMATION PER TCDI 2003-01					
1	SPC	ADD	1	PPH	10/11/72
ADD WELD INFORMATION PER TCDI 2003-01					
REV	BY	DATE	SHEET	APPENDIX	
TENNESSEE VALLEY AUTHORITY					
SEQUOYAH NUCLEAR PLANT					
UNIT 2					
REACTOR VESSEL					
BOTTOM HEAD PENETRATIONS					

Sort (Scan No.)

**SQN Unit 2, Cycle 12**  
**RPV Lower Head, Remote Visual Scan Plan**

Scan No.	Penetration ID	Location	Direction	Tape No.	Tape Count hrs:min:sec	Rust on head	Loose Coating	Boron on Penetration	Boron Originating from Crevice	Masked (Indeterminate)	Requires Cleaning	Other	NRI	Examiner Initials	Comments
1	52	180	Fore	1	0:01:20								X	MCW	
1	43	180	Fore	1	0:01:54								X	MCW	
1	43	180	Aft	1	0:02:32								X	MCW	
1	52	180	Aft	1	0:03:29								X	MCW	
2	55	180	Fore	1	0:04:25								X	MCW	
2	36	180	Fore	1	0:05:24								X	MCW	
2	40	180	Fore	1	0:05:51								X	MCW	
2	49	180	Fore	1	0:06:15								X	MCW	
2	49	180	Aft	1	0:07:59								X	MCW	
2	40	180	Aft	1	0:08:38								X	MCW	
2	36	180	Aft	1	0:09:12								X	MCW	
2	55	180	Aft	1	0:09:45								X	MCW	
3	45	180	Fore	1	0:10:35								X	MCW	
3	32	180	Fore	1	0:10:52							X	X	MCW	Black Stain
3	24	180	Fore	1	0:12:30								X	MCW	LPM Clamp & Stain
3	58	180	Fore	1	0:13:29								X	MCW	
3	58	180	Aft	1	0:15:03								X	MCW	
3	24	180	Aft	1	0:15:28								X	MCW	
3	32	180	Aft	1	0:16:51								X	MCW	
3	45	180	Aft	1	0:17:12								X	MCW	
4	22	180	Fore	1	0:18:10								X	MCW	Stain
4	17	180	Fore	1	0:19:10								X	MCW	
4	31	180	Fore	1	0:19:46								X	MCW	
4	31	180	Aft	1	0:20:09								X	MCW	
4	17	180	Aft	1	0:20:24								X	MCW	

Sort (Scan No.)

**SQN Unit 2, Cycle 12**  
**RPV Lower Head, Remote Visual Scan Plan**

Scan No.	Penetration ID	Location	Direction	Tape No.	Tape Count hrs:min:sec	Rust on head	Loose Coating	Boron on Penetration	Boron Originating from Crevice	Masked (Indeterminate)	Requires Cleaning	Other	NRI	Examiner Initials	Comments
4	22	180	Aft	1	0:20:59								X	MCW	
5	53	180	Fore	1	0:21:21								X	MCW	
5	18	180	Fore	1	0:22:00								X	MCW	Stain
5	9	180	Fore	1	0:23:00								X	MCW	Stain
5	21	180	Fore	1	0:23:42								X	MCW	Stain
5	54	180	Fore	1	0:24:24								X	MCW	
5	54	180	Aft	1	0:25:00								X	MCW	
5	21	180	Aft	1	0:25:31								X	MCW	
5	9	180	Aft	1	0:25:51								X	MCW	
5	18	180	Aft	1	0:26:06								X	MCW	
5	53	180	Aft	1	0:21:46								X	MCW	
6	13	180	Fore	1	0:26:34								X	MCW	Stain
6	6	180	Fore	1	0:27:20								X	MCW	Stain
6	23	180	Fore	1	0:28:16								X	MCW	
6	23	180	Aft	1	0:28:59								X	MCW	Stain
6	6	180	Aft	1	0:29:37								X	MCW	
6	13	180	Aft	1	0:30:11								X	MCW	
7	37	180	Fore	1	0:30:44								X	MCW	
7	3	180	Fore	1	0:31:04								X	MCW	
7	12	180	Fore	1	0:31:33								X	MCW	
7	47	180	Fore	1	0:31:51								X	MCW	Stain
7	47	180	Aft	1	0:32:56								X	MCW	
7	12	180	Aft	1	0:33:21								X	MCW	
7	3	180	Aft	1	0:34:34								X	MCW	
7	37	180	Aft	1	0:35:02								X	MCW	

Sort (Scan No.)

**SQN Unit 2, Cycle 12**  
**RPV Lower Head, Remote Visual Scan Plan**

Scan No.	Penetration ID	Location	Direction	Tape No.	Tape Count hrs:min:sec	Rust on head	Loose Coating	Boron on Penetration	Boron Originating from Crevice	Masked (Indeterminate)	Requires Cleaning	Other	NRI	Examiner Initials	Comments
8	44	180	Fore	1	0:35:55								X	MCW	
8	25	180	Fore	1	0:36:33								X	MCW	Stain
8	10	180	Fore	1	0:37:47								X	MCW	
8	1	180	Fore	1	0:38:14								X	MCW	
8	5	180	Fore	1	0:38:44								X	MCW	
8	15	180	Fore	1	0:39:06								X	MCW	Stain
8	27	180	Fore	1	0:40:15								X	MCW	Stain
8	35	180	Fore	1	0:41:10								X	MCW	Stain
8	35	180	Aft	1	0:48:17								X	MCW	
8	27	180	Aft	1	0:49:08								X	MCW	Stain
8	15	180	Aft	1	0:51:11								X	MCW	Stain
8	5	180	Aft	1	0:52:37								X	MCW	Stain
8	1	180	Aft	1	0:54:20								X	MCW	
8	10	180	Aft	1	0:56:05								X	MCW	
8	25	180	Aft	1	0:57:10								X	MCW	
8	44	180	Aft	1	0:57:40							X	X	MCW	Minute (1/16") white particle at crevice. Verified with direct VT as non-relevant. End Tape No. 1
9	16	180	Fore	1	0:43:47								X	MCW	Stain
9	2	180	Fore	1	0:44:57								X	MCW	Stain
9	7	180	Fore	1	0:45:27								X	MCW	
9	28	180	Fore	1	0:45:51								X	MCW	
9	28	180	Aft	1	0:50:21								X	MCW	Stain
9	7	180	Aft	1	0:53:39								X	MCW	Stain
9	2	180	Aft	1	0:55:05								X	MCW	Stain
9	16	180	Aft	1	0:56:27								X	MCW	

Sort (Scan No.)

**SQN Unit 2, Cycle 12**  
**RPV Lower Head, Remote Visual Scan Plan**

Scan No.	Penetration ID	Location	Direction	Tape No.	Tape Count hrs:min:sec	Rust on head	Loose Coating	Boron on Penetration	Boron Originating from Crevice	Masked (Indeterminate)	Requires Cleaning	Other	NRI	Examiner Initials	Comments
10	50	180	Fore	2	0:00:25								X	MCW	
10	29	180	Fore	2	0:01:35								X	MCW	
10	8	180	Fore	2	0:02:32								X	MCW	
10	4	180	Fore	2	0:02:55								X	MCW	
10	39	180	Fore	2	0:03:34								X	MCW	
10	39	180	Aft	2	0:05:55								X	MCW	General overview of head condition on Tape No. 2 @ 4:22 cts.
10	4	180	Aft	2	0:06:30								X	MCW	Also examined by FCL on Tape 2; 14:14 cts.
10	8	180	Aft	2	0:08:06								X	MCW	Also examined by FCL on Tape 2; 13:29 cts.
10	29	180	Aft	2	0:09:01								X	MCW	
10	50	180	Aft	2	0:09:45								X	MCW	
11	19	180	Fore	2	0:01:41								X	FCL	Tape rezeroed after power loss.
11	11	180	Fore	2	0:03:44								X	FCL	
11	20	180	Fore	2	0:04:23								X	FCL	
11	33	180	Fore	2	0:05:42								X	FCL	Stains
11	33	180	Aft	2	0:07:15								X	FCL	
11	20	180	Aft	2	0:08:22								X	FCL	Coating on tube
11	11	180	Aft	2	0:10:55								X	FCL	Coating on tube
11	19	180	Aft	2	0:11:45								X	FCL	Coating on tube
12	48	180	Fore	2	0:15:05								X	FCL	Stains
12	41	180	Fore	2	0:15:27								X	FCL	
12	14	180	Fore	2	0:16:04								X	FCL	
12	14	180	Aft	2	0:17:31								X	FCL	Coating on tube
12	41	180	Aft	2	0:18:38								X	FCL	

Sort (Scan No.)

**SQN Unit 2, Cycle 12**  
**RPV Lower Head, Remote Visual Scan Plan**

Scan No.	Penetration ID	Location	Direction	Tape No.	Tape Count hrs:min:sec	Rust on head	Loose Coating	Boron on Penetration	Boron Originating from Crevice	Masked (Indeterminate)	Requires Cleaning	Other	NRI	Examiner Initials	Comments
12	48	180	Aft	2	0:20:48								X	FCL	
13	26	180	Fore	2	0:21:32								X	FCL	
13	30	180	Fore	2	0:22:16								X	FCL	
13	42	180	Fore	2	0:23:33								X	FCL	
13	57	180	Fore	2	0:24:30								X	FCL	
13	57	180	Aft	2	0:25:56								X	FCL	
13	42	180	Aft	2	0:26:43								X	FCL	
13	30	180	Aft	2	0:29:07								X	FCL	Coating on tube
13	26	180	Aft	2	0:29:44								X	FCL	Coating on tube
14	56	180	Fore	2	0:31:28								X	FCL	
14	38	180	Fore	2	0:32:07								X	FCL	Coating on tube
14	34	180	Fore	2	0:33:55								X	FCL	
14	34	180	Aft	2	0:34:53								X	FCL	Tape residue
14	38	180	Aft	2	0:35:11								X	FCL	
14	56	180	Aft	2	0:36:03								X	FCL	
15	46	180	Fore	2	0:40:21								X	FCL	
15	51	180	Fore	2	0:41:17								X	FCL	
15	51	180	Aft	2	0:42:25								X	FCL	
15	46	180	Aft	2	0:43:41								X	FCL	

Tape No. 2, 36:50 counts to 40:20 counts (General under head visual)

<b>Original Signed</b>					<b>11/14/2003</b>					<b>Original Signed</b>					<b>11/12/2003</b>				
Frank Leonard, TVA Level III					Date					Matt Welch, TVA Level III					Date				

Sort (Penetration ID)

**SQN Unit 2, Cycle 12**  
**RPV Lower Head, Remote Visual Scan Plan**

Scan No.	Penetration ID	Location	Direction	Tape No.	Tape Count hrs:min:sec	Rust on head	Loose Coating	Boron on Penetration	Boron Originating from Crevice	Masked (Indeterminate)	Requires Cleaning	Other	NRI	Examiner Initials	Comments
8	1	180	Fore	1	0:38:14								X	MCW	
8	1	180	Aft	1	0:54:20								X	MCW	
9	2	180	Fore	1	0:44:57								X	MCW	Stain
9	2	180	Aft	1	0:55:05								X	MCW	Stain
7	3	180	Fore	1	0:31:04								X	MCW	
7	3	180	Aft	1	0:34:34								X	MCW	
10	4	180	Fore	2	0:02:55								X	MCW	
10	4	180	Aft	2	0:06:30								X	MCW	cts.
8	5	180	Fore	1	0:38:44								X	MCW	
8	5	180	Aft	1	0:52:37								X	MCW	Stain
6	6	180	Fore	1	0:27:20								X	MCW	Stain
6	6	180	Aft	1	0:29:37								X	MCW	
9	7	180	Fore	1	0:45:27								X	MCW	
9	7	180	Aft	1	0:53:39								X	MCW	Stain
10	8	180	Fore	2	0:02:32								X	MCW	
10	8	180	Aft	2	0:08:06								X	MCW	cts.
5	9	180	Fore	1	0:23:00								X	MCW	Stain
5	9	180	Aft	1	0:25:51								X	MCW	
8	10	180	Fore	1	0:37:47								X	MCW	
8	10	180	Aft	1	0:56:05								X	MCW	
11	11	180	Fore	2	0:03:44								X	FCL	
11	11	180	Aft	2	0:10:55								X	FCL	Coating on tube
7	12	180	Fore	1	0:31:33								X	MCW	
7	12	180	Aft	1	0:33:21								X	MCW	
6	13	180	Fore	1	0:26:34								X	MCW	Stain



Sort (Penetration ID)

**SQN Unit 2, Cycle 12**  
**RPV Lower Head, Remote Visual Scan Plan**

Scan No.	Penetration ID	Location	Direction	Tape No.	Tape Count hrs:min:sec	Rust on head	Loose Coating	Boron on Penetration	Boron Originating from Crevice	Masked (Indeterminate)	Requires Cleaning	Other	NRI	Examiner Initials	Comments
6	13	180	Aft	1	0:30:11								X	MCW	
12	14	180	Fore	2	0:16:04								X	FCL	
12	14	180	Aft	2	0:17:31								X	FCL	Coating on tube
8	15	180	Fore	1	0:39:06								X	MCW	Stain
8	15	180	Aft	1	0:51:11								X	MCW	Stain
9	16	180	Fore	1	0:43:47								X	MCW	Stain
9	16	180	Aft	1	0:56:27								X	MCW	
4	17	180	Fore	1	0:19:10								X	MCW	
4	17	180	Aft	1	0:20:24								X	MCW	
5	18	180	Fore	1	0:22:00								X	MCW	Stain
5	18	180	Aft	1	0:26:06								X	MCW	
11	19	180	Fore	2	0:01:41								X	FCL	Tape rezeroed after power loss.
11	19	180	Aft	2	0:11:45								X	FCL	Coating on tube
11	20	180	Fore	2	0:04:23								X	FCL	
11	20	180	Aft	2	0:08:22								X	FCL	Coating on tube
5	21	180	Fore	1	0:23:42								X	MCW	Stain
5	21	180	Aft	1	0:25:31								X	MCW	
4	22	180	Fore	1	0:18:10								X	MCW	Stain
4	22	180	Aft	1	0:20:59								X	MCW	
6	23	180	Fore	1	0:28:16								X	MCW	
6	23	180	Aft	1	0:28:59								X	MCW	Stain
3	24	180	Fore	1	0:12:30								X	MCW	LPM Clamp & Stain
3	24	180	Aft	1	0:15:28								X	MCW	
8	25	180	Fore	1	0:36:33								X	MCW	Stain
8	25	180	Aft	1	0:57:10								X	MCW	

Sort (Penetration ID)

**SQN Unit 2, Cycle 12**  
**RPV Lower Head, Remote Visual Scan Plan**

Scan No.	Penetration ID	Location	Direction	Tape No.	Tape Count hrs:min:sec	Rust on head	Loose Coating	Boron on Penetration	Boron Originating from Crevice	Masked (Indeterminate)	Requires Cleaning	Other	NRI	Examiner Initials	Comments
13	26	180	Fore	2	0:21:32								X	FCL	
13	26	180	Aft	2	0:29:44								X	FCL	Coating on tube
8	27	180	Fore	1	0:40:15								X	MCW	Stain
8	27	180	Aft	1	0:49:08								X	MCW	Stain
9	28	180	Fore	1	0:45:51								X	MCW	
9	28	180	Aft	1	0:50:21								X	MCW	Stain
10	29	180	Fore	2	0:01:35								X	MCW	
10	29	180	Aft	2	0:09:01								X	MCW	
13	30	180	Fore	2	0:22:16								X	FCL	
13	30	180	Aft	2	0:29:07								X	FCL	Coating on tube
4	31	180	Fore	1	0:19:46								X	MCW	
4	31	180	Aft	1	0:20:09								X	MCW	
3	32	180	Fore	1	0:10:52							X	X	MCW	Black Stain
3	32	180	Aft	1	0:16:51								X	MCW	
11	33	180	Fore	2	0:05:42								X	FCL	Stains
11	33	180	Aft	2	0:07:15								X	FCL	
14	34	180	Fore	2	0:33:55								X	FCL	
14	34	180	Aft	2	0:34:53								X	FCL	Tape residue
8	35	180	Fore	1	0:41:10								X	MCW	Stain
8	35	180	Aft	1	0:48:17								X	MCW	
2	36	180	Fore	1	0:05:24								X	MCW	
2	36	180	Aft	1	0:09:12								X	MCW	
7	37	180	Fore	1	0:30:44								X	MCW	
7	37	180	Aft	1	0:35:02								X	MCW	
14	38	180	Fore	2	0:32:07								X	FCL	Coating on tube

Sort (Penetration ID)

**SQN Unit 2, Cycle 12**  
**RPV Lower Head, Remote Visual Scan Plan**

Scan No.	Penetration ID	Location	Direction	Tape No.	Tape Count hrs:min:sec	Rust on head	Loose Coating	Boron on Penetration	Boron Originating from Crevice	Masked (Indeterminate)	Requires Cleaning	Other	NRI	Examiner Initials	Comments
14	38	180	Aft	2	0:35:11								X	FCL	
10	39	180	Fore	2	0:03:34								X	MCW	
10	39	180	Aft	2	0:05:55								X	MCW	Tape No. 2 @ 4:22 cts.
2	40	180	Fore	1	0:05:51								X	MCW	
2	40	180	Aft	1	0:08:38								X	MCW	
12	41	180	Fore	2	0:15:27								X	FCL	
12	41	180	Aft	2	0:18:38								X	FCL	
13	42	180	Fore	2	0:23:33								X	FCL	
13	42	180	Aft	2	0:26:43								X	FCL	
1	43	180	Fore	1	0:01:54								X	MCW	
1	43	180	Aft	1	0:02:32								X	MCW	
8	44	180	Fore	1	0:35:55								X	MCW	
8	44	180	Aft	1	0:57:40							X	X	MCW	Verified with direct VT as non-relevant. End
3	45	180	Fore	1	0:10:35								X	MCW	
3	45	180	Aft	1	0:17:12								X	MCW	
15	46	180	Fore	2	0:40:21								X	FCL	
15	46	180	Aft	2	0:43:41								X	FCL	
7	47	180	Fore	1	0:31:51								X	MCW	Stain
7	47	180	Aft	1	0:32:56								X	MCW	
12	48	180	Fore	2	0:15:05								X	FCL	Stains
12	48	180	Aft	2	0:20:48								X	FCL	
2	49	180	Fore	1	0:06:15								X	MCW	
2	49	180	Aft	1	0:07:59								X	MCW	
10	50	180	Fore	2	0:00:25								X	MCW	
10	50	180	Aft	2	0:09:45								X	MCW	
15	51	180	Fore	2	0:41:17								X	FCL	

Sort (Penetration ID)

**SQN Unit 2, Cycle 12**  
**RPV Lower Head, Remote Visual Scan Plan**

Scan No.	Penetration ID	Location	Direction	Tape No.	Tape Count hrs:min:sec	Rust on head	Loose Coating	Boron on Penetration	Boron Originating from Crevice	Masked (Indeterminate)	Requires Cleaning	Other	NRI	Examiner Initials	Comments
15	51	180	Aft	2	0:42:25								X	FCL	
1	52	180	Fore	1	0:01:20								X	MCW	
1	52	180	Aft	1	0:03:29								X	MCW	
5	53	180	Fore	1	0:21:21								X	MCW	
5	53	180	Aft	1	0:21:46								X	MCW	
5	54	180	Fore	1	0:24:24								X	MCW	
5	54	180	Aft	1	0:25:00								X	MCW	
2	55	180	Fore	1	0:04:25								X	MCW	
2	55	180	Aft	1	0:09:45								X	MCW	
14	56	180	Fore	2	0:31:28								X	FCL	
14	56	180	Aft	2	0:36:03								X	FCL	
13	57	180	Fore	2	0:24:30								X	FCL	
13	57	180	Aft	2	0:25:56								X	FCL	
3	58	180	Fore	1	0:13:29								X	MCW	
3	58	180	Aft	1	0:15:03								X	MCW	

Tape No. 2, 36:50 counts to 40:20 counts (General under head visual)

<i>Original Signed</i>					11/14/2003					<i>Original Signed</i>					11/12/2003				
Frank Leonard, TVA Level III					Date					Matt Welch, TVA Level III					Date				

150  
Sequoyah Unit 2, Cycle 12 – RPV Lower Head  
Remote Visual (VT-2) BMI Penetration Examination Final Report

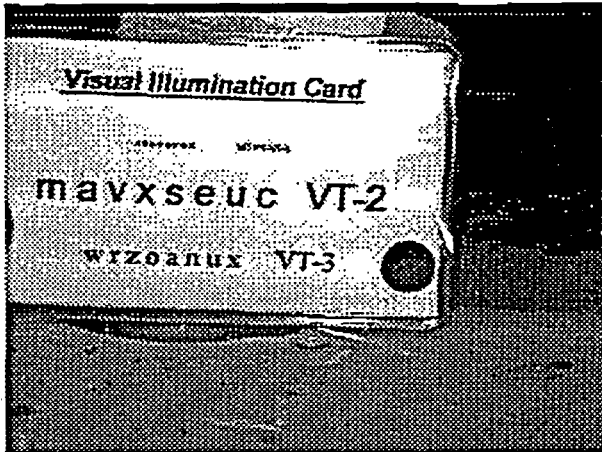


Figure 1  
Resolution check @ 14"

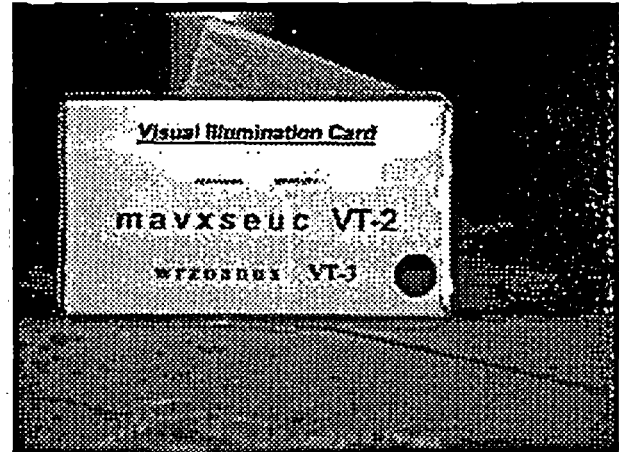


Figure 2  
Resolution check @ 38"



Figure 3 – BMI No. 25  
General Condition

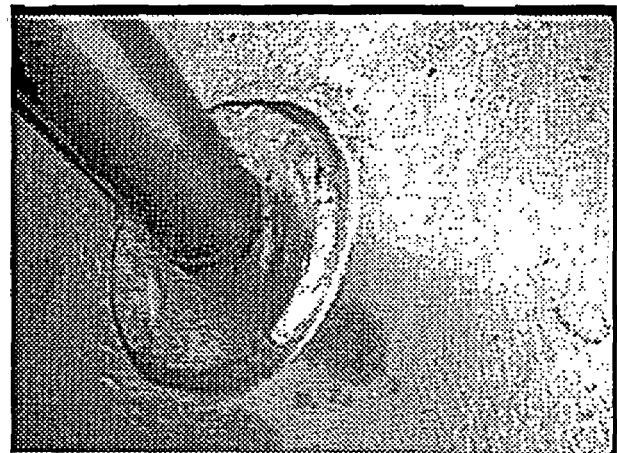


Figure 4 – BMI 26  
General Condition



Figure 5 – BMI 26  
General Condition

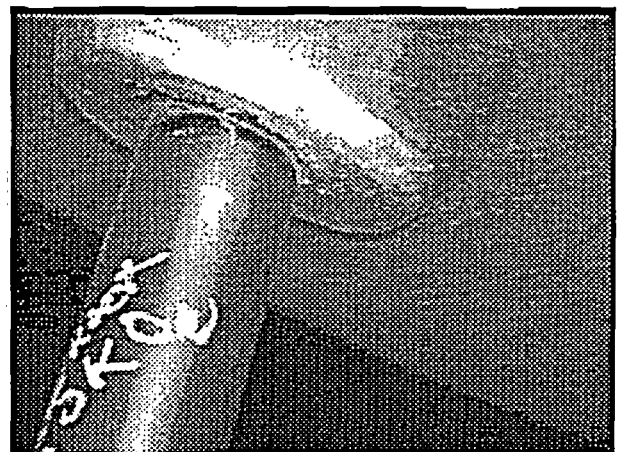


Figure 6 – BMI 33  
General Condition

ISO

Sequoyah Unit 2, Cycle 12 – RPV Lower Head  
Remote Visual (VT-2) BMI Penetration Examination Final Report

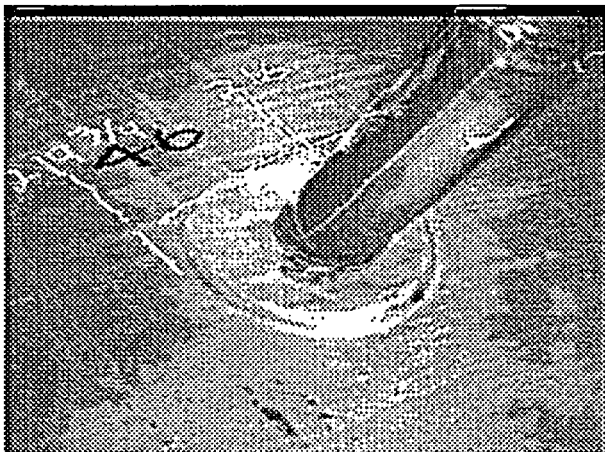


Figure 7 – BMI 46  
General Condition

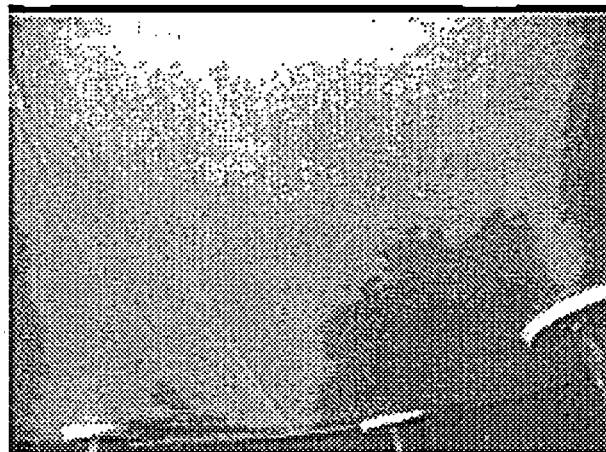


Figure 8  
General Lower Head Surface Condition

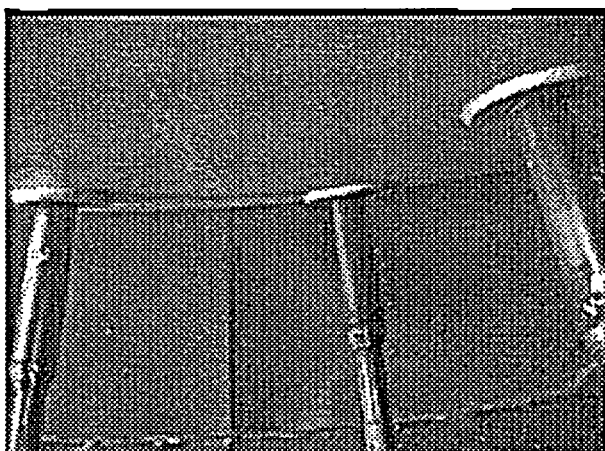


Figure 9  
General Lower Head Surface Condition



Figure 10  
General Lower Head Surface Condition



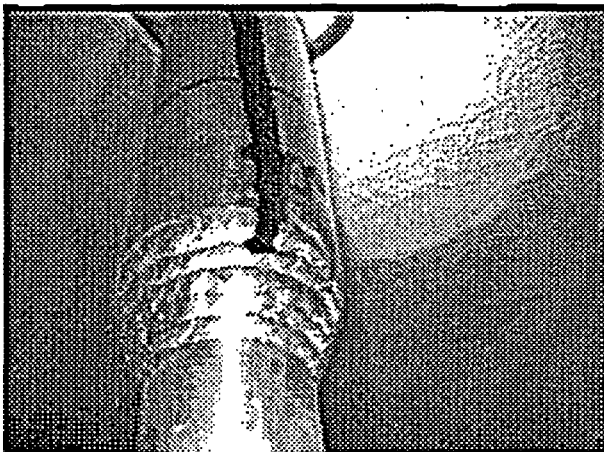
Figure 11  
General Lower Head Surface Condition



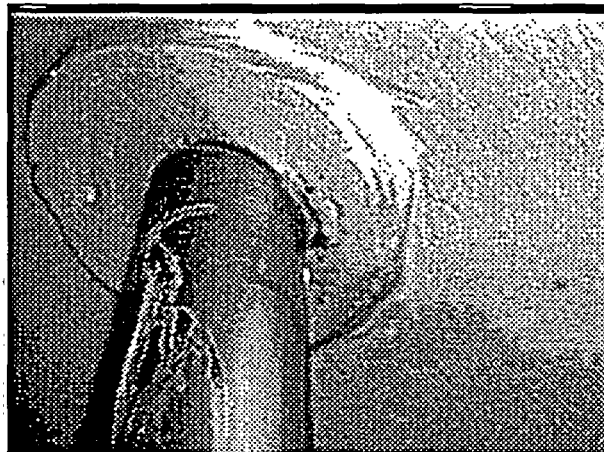
Figure 12  
General Lower Head Surface Condition

150

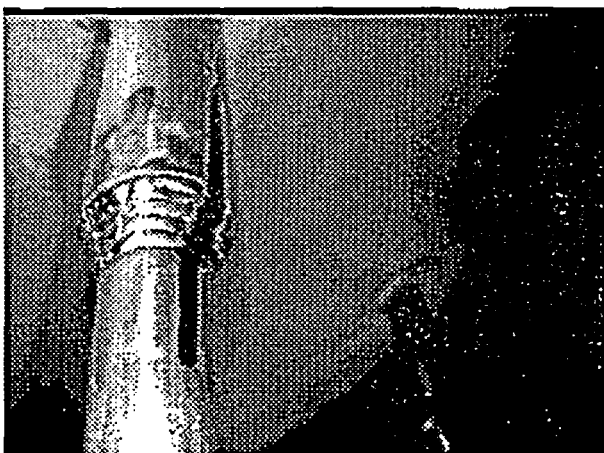
Sequoyah Unit 2, Cycle 12 – RPV Lower Head  
Remote Visual (VT-2) BMI Penetration Examination Final Report



**Figure 13 – BMI 23**  
General View of Black Coating/Stain



**Figure 14 – BMI 24**  
General View of Black Coating/Stain



**Figure 15 – BMI 24**  
General View of Black Coating/Stain



**Figure 16 – BMI 25**  
General View of Black Coating/Stain

**SQN Unit 2, Cycle 12, RPV Lower Head  
VT-2 - Resolution Check Verifications**

Date	Time	Tape No.	Count	Examiner Initials	Visual Exam Card ID No.	Character Height	Distance	Results	Comments
11/11/03	2210	1	0:00:30	MCW	285	.105"	38"	SAT	VT Card at Nozzle No. 55
11/12/03	510	2	0:00:15	MCW	285	.105"	38"	SAT	
11/12/03	900	2	0:11:04	FCL	285	.105"	14" & 38"	SAT	
11/12/03	0:00	2	0:45:28	FCL	285	.105"	14" & 38"	SAT	
	<i>Original Signed</i>				11/13/2003				
	Frank Leonard, TVA Level III					Date			
	<i>Original Signed</i>				11/12/2003				
	Matt Welch, TVA Level III					Date			



ENCLOSURE 2

TENNESSEE VALLEY AUTHORITY  
SEQUOYAH NUCLEAR PLANT (SQN)  
UNIT 2

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Reactor Pressure Vessel (RPV)  
Lower Head Examination Results  
(Exterior Residue Analysis)

SQN Unit 2 Cycle 12 (U2C12) Refueling Outage (RFO)  
Reactor Pressure Vessel (RPV)  
Bottom Mounted Instrumentation (BMI)

Thimble Guide Tubes, Exterior Residue Analysis

Background:

During the SQN U2C12 RFO, a remote visual examination was performed to evaluate the integrity of the BMI's by looking for evidence of leakage from the vessel at each penetration. South Texas Plant recently identified leakage in this area prompting SQN to perform this examination. The inspection was performed by VISTA's and evaluated by TVA Level III inspectors and was determined to be acceptable, i.e., no indication of reactor coolant leakage from the penetrations. During the inspection, however, residual deposits were identified on the exterior surface of the guide tubes that were either white or dark reddish in color. The dark substance was also described as "tar-like". SQN has initiated PER 03-16523 to document and evaluate these findings.

Discussion:

Several attempts were made to obtain a representative sample of the residual deposits to perform chemical analysis. Due to the tightly adhering nature of the deposits, pure samples were extremely difficult to obtain. Wet sponge swipe tests as well as residual scrapings were both attempted.

The swipe test performed showed some evidence of boron. This is most likely associated with the "white" substance and is likely boric acid residue remaining after leakage that occurred during reactor cavity flood-up. The boric acid deposits are dry and have historically not adversely affected stainless steel and nickel alloy materials.

Discussions with site personnel involved in the construction phase of SQN have led to the determination that the substance described as dark and "tar-like" is most likely residue from flagging tape (non-adhesive) used for identification purposes. The flagging was not removed prior to startup and has consequently melted and adhered to the surface of the guide tubes.

The chemical analysis performed on this residue does indicate the presence of some fluorides, chlorides, and sulfates. An accurate measurement of total halogens and sulfates associated with this residue could not be qualified due to the irregular nature of the surfaces (small diameter pipe) and the difficulty in obtaining the samples. However, the quantities reported do not appear to

be an alarming level from a consideration of stress corrosion cracking. In addition, the unit is in the twelfth cycle of operation and has never identified any problems such as reported leakage in this area.

Westinghouse considers the BMI's to be a Class D cleanliness level as defined by Westinghouse Process Specification 292722. This level of cleanliness specifies that surfaces be free of contaminating materials such as grease, oil, and dirt but does not require testing to ensure halogen levels are below specified levels. The other Westinghouse cleanliness levels do require surface testing to determine halogen levels.

Stress corrosion cracking of the BMI's is not believed to be an issue due to the residual material from the flagging material based on the above evaluation. In order to further substantiate this determination, a liquid penetrant examination using the fluorescent water washable method (N-PT-7) has been performed on three guide tubes (#26, #30, and #46). No recordable indications were identified during the non-destructive examination. Final disposition of this issue is documented in PER 03-16523.